PATENT SPECIFICATION

755,316

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The inventor of this invention in the sense of being the actual deviser thereof within the meaning of Section 16 of the Patents Act, 1949, is OVE PETERSEN, a Danish subject, of 3, Dronningemarken, Gentofte, Denmark.

COMPLETE SPECIFICATION

Fuel Injection Valves for Internal Combustion Engines

We, AKTIESELSKABET BURMEISTER & WAIN'S MASKIN- OG SKIBSBYGGERI, a company organised under the laws of Denmark, of No. 4, Strandgadi, Copenhagen, Denmark, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with fuel injection valves for internal combustion engines.

Fuel injection valves are known composed of a valve guide member and a separate atomizer body which is clamped against the lower end face of the valve guide member and which carries the valve seat co-operating with the valve spindle, or needle valve, from which seat the fuel channel or fuel channels leading to the injection orifices issue. Fuel valves of this type possess certain advantages over that type of fuel valve where the valve guide member and the atomizer body are integral since with the latter types a series of machining difficulties are encountered. This is especially so as regards the grinding of the valve seat which is necessary after a period of operation in order to obtain the required tightness of the valve. Fuel valves of the former type are, however, relatively free from such machining difficulties since the valve seat is easily accessible for machining when the atomizer body is removed from the valve guide member.

In fuel injection valves of the former type it has, however, proved difficult to obtain both a satisfactory injection and a sufficient cooling of the fuel. As regards the cooling, it is known to let the atomizer body proper be surrounded by an outer cooling body (see, for example, the specification of British Patent No. 545,633) in such a way that an annular space for a cooling agent with supply and outlet channels for the cooling agent is provided between the said two bodies. In one known fuel injection valve of the former type the atomizer body is designed substantially as a slender cylinder having a collar at its upper end which rests within a recess in the surrounding cooling body. The valve seat is formed on the upper side of this collar, i.e. on the upper side of the atomizer body facing the valve guide member. In order to provide the necessary room for the cooling space between the cooling body and the atomizer body, the latter must be of considerable length, and thus the fuel channel, leading from this valve seat to the atomizer holes in or at the bottom of the atomizer body are of considerable length. In practice, the fuel channel has a comparatively large diameter which may be such that the velocity of the fuel in the channel will become about one fourth of that velocity in the atomizer holes. Fuel oil in the fuel channel is cooled as much as possible by the cooling agent flowing through the cooling space surrounding the atomizer, body, the cooling agent thus serving to counteract coking in and on the atomizer body. However, especially when poorer qualities of fuel oil are used, which may be the case in marine Diesel engines, a coking occurs in and around the atomizer holes despite this cooling. This would appear to be due to the fact that after the closing of the valve a seeping out or after dripping of the fuel occurs and this extra fuel is not atomized or at any rate not sufficiently atomized for ensuring complete combustion thereof.

In more recent fuel injection valves an attempt has been made to overcome this after-dripping by shortening and narrowing the fuel channel, and this is attained by the use of an atomizer body in the form of a plate having the smallest height allowed by constructional requirements. Such atomizers will in some circumstances function satisfactorily, but in other

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cases it has proved difficult to cool the atomizer sufficiently because the cooling space is limited to a groove provided in the upper side of the atomizer plate, which groove extends around the valve seat.

The purpose of the present invention is to provide a fuel injection valve in which the drawbacks of the known constructions are substantially reduced, or in other words to provide a fuel injection valve which is practical from the point of view of machining the valve seat after a period of use and enable a substantially complete combustion of the fuel in the cylinder to be obtained. According to the invention a cooled fuel injection valve for an internal combustion engine comprises a valve guide member, a separate atomizer body, the upper side of which is held against the lower end face of the valve guide and which is provided with a valve seat, a longitudinal fuel channel in the atomizer body which connects the valve seat to one or more atomizer holes, and a cooling body surrounding the atomizer body and adapted with the atomizer body to define a space for a cooling agent characterised in that the valve seat is disposed below the upper surface of the atomizer body so that the length of the said fuel channel is substantially shorter than the length of the atomizer body.

In comparison with previously known fuel injection valves with an atomizer body separate from the valve guide member and a cooling body surrounding the atomizer body, a valve in accordance with the invention has the advantage that a very considerable reduction of the length of the fuel channel leading from the valve seat to the injection holes is possible, and this, particularly when the channel is narrow, is of vital importance for avoiding the inconvenient after-dripping thereby obtaining the desired complete combustion of the fuel injected through the valve.

According to a feature of the invention the valve seat may conveniently lie at least substantially at the level of the cooling space. With such an arrangement effective cooling of the oil passing along the fuel channel will be obtained.

A fuel injection valve according to one embodiment of the invention is shown on the accompanying drawing in axial section and partly diagrammatically.

1 designates the valve guide member of the valve, in which guide the needle valve or valve spindle 2 is mounted for sliding movement and which has a plane lower-end-face 3. The injection nozzle or atomizer proper is composed of an atomizer body 4 and a cooling body 5 surrounding the latter. The atomizer body 4 is substantially cylindrical and at its top is provided with a collar 6 resting in a recess in the cooling body 5. The upper faces of the atomizer body 4 and the cooling body 5 lie in the same plane and are kept in sealing contact with the lower face 3 of the valve guide 1 by means of a union nut 7 which engages under the cooling body 5 and is secured to the valve guide 1 by a screw thread 8. In the cooling body 5 an annular space 9 for a cooling agent is recessed out being open towards the atomizer body 4. A suitable cooling agent is supplied to the cooling space through a supply channel 10 in the cooling body and the valve guide 1 and leaves through an outlet channel, not shown, through the same parts.

In the upper part of the atomizer body 4 a wide bore 11 is provided which serves as a fuel chamber, which through a channel 12 in the valve guide member 1 is in communication with a fuel pump, not shown, and which receives the lower end of the valve spindle 2, this lower end being of smaller diameter than the remaining portion of the valve spindle. The bore 11 has a plane bottom forming the valve seat 12^1 co-operating with the valve spindle, from which seat the fuel channel 13 of the atomizer body issues. As appears clearly from the drawing, the valve seat 12^1 is countersunk below the upper surface of the atomizer body and the fuel channel 13 has a very limited length, preferably of the order of magnitude of 7—10 mm. At the same time it is so narrow that the velocity of the fuel in the channel 13 during the injection operation proper can be at substantially the same order of magnitude as the velocity in the atomizer holes 14 (only one of which is shown in the drawing) at the lower end of the channel. These atomizer holes are provided in a nose portion 15 which has a smaller diameter than the main portion of the atomizer body 4, so that the atomizer holes are of short length.

In the embodiment shown the valve seat 12^1 and thereby also the lower part of the fuel chamber 11 are located at the level of the cooling agent space 9, and this results in an especially effective cooling, as explained above. This specific location of the valve seat is not, however, absolutely necessary, the main requirement being that the dimensions of the fuel channel 13, especially insofar as its length is concerned, are reduced as much as possible while maintaining an effective cooling of the nozzle.

It is pointed out that the cooling agent space need not, as shown on the drawing, be formed by a recess in the cooling body 5 closed by the atomizer body 4, but may also be formed by a recess in the atomizer body 4 closed by the cooling body 5 or be formed by co-operating recesses in both bodies.

What we claim is:—

1. A fuel injection valve for an internal combustion engine comprising a valve guide member, a separate atomizer body the upper side of which is held against the lower end face of the valve guide and which is provided with a valve seat, a longitudinal fuel channel

in the atomizer body which connects the valve seat to one or more atomizer holes, and a cooling body surrounding the atomizer body and adapted with the atomizer body to define a space for a cooling agent characterised in that the valve seat is disposed below the upper surface of the atomizer body so that the length of the said fuel channel is substantially shorter than the length of the atomizer body.

2. A fuel injection valve as claimed in claim 1, characterised in that the valve seat lies at least substantially at the level of the cooling space.

3. A cooled fuel injection valve for an internal combustion engine, substantially as described with reference to the accompanying drawing.

CARPMAELS & RANSFORD,
Agents for Applicants,
24, Southampton Buildings,
Chancery Lane, London, W.C.2.

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755,316 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.